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CLAIMS

1. A columnar structured material obtained by introducing a filler into columnar holes formed in a porous material,

5 wherein the porous material has the columnar holes formed by removing columnar substances from a structured material in which the columnar substances containing a first component are dispersed in a matrix member containing a second component capable
10 of forming a eutectic with the first component.

2. The columnar structured material according to claim 1, wherein the structured material has a thin film form.

3. The columnar structured material according
15 to claim 1, wherein the columnar structured material is obtained by introducing the filler into the columnar holes after subjecting the porous material to chemical treatment.

4. The columnar structured material according
20 to claim 3, wherein the chemical treatment is oxidation treatment.

5. The columnar structured material according to claim 1, wherein the columnar substance is aluminum, the matrix member is of silicon, and the
25 proportion of silicon to the structured material is in a range from 20 atomic% to 70 atomic%.

6. The columnar structured material according

to claim 1, wherein the columnar substance is aluminum, the matrix member is of germanium, and the proportion of germanium to the structured material is in a range from 20 atomic% to 70 atomic%.

5 7. The columnar structured material according to claim 1, wherein a main component of the porous material is silicon.

8. The columnar structured material according to claim 1, wherein a main component of the porous
10 material is germanium.

9. The columnar structured material according to claim 1, wherein the diameter of a filler region of the columnar structured material is in a range from 0.5 nm to 15 nm.

15 10. The columnar structured material according to claim 1, wherein the interval between filler regions of the columnar structured material is in a range from 5 nm to 20 nm.

11. The columnar structured material according to claim 1, wherein the columnar substance is a
20 crystalline substance, and the matrix member is of an amorphous substance.

12. The columnar structured material according to claim 1, wherein the filler introduced into the
25 holes of the porous material is a metal or a semiconductor.

13. The columnar structured material according

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to claim 1, wherein the matrix member is removed from the columnar structured material.

14. An electrode having the columnar structured material according to claim 13,

5 wherein the filler is a conductive material, the conductive material in at least a part of a plurality of holes being electrically connected to a conductor.

15. A method for producing a columnar
10 structured material, comprising: a step of preparing a structured material in which columnar substances containing a first component are dispersed in a matrix member containing a second component capable of forming a eutectic with the first component; a
15 removing step of removing the columnar substances; and an introducing step of introducing a filler into columnar holes that are formed in a porous material in the removing step.

16. The method for producing a columnar
20 structured material according to claim 15, comprising an additional step of subjecting the porous material to chemical treatment after the removing step.

17. The method for producing a columnar
structured material according to claim 15, wherein
25 the removing step is performed by etching.

18. The method for producing a columnar
structured material according to claim 15, wherein

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the introducing step is performed by electrodeposition.

19. The method for producing a columnar structured material according to claim 15, wherein
5 the introducing step is performed by electroless deposition.

20. The method for producing a columnar structured material according to claim 15 , wherein
the introducing step is performed by catalytic
10 reaction after forming a catalyst in a bottom portion of the hole.